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and constructions shown and described, since various other modifications may occur to those with ordinary skill in the art.

IN THE CLAIMS:

1 10. (Twice Amended) DC to DC switching circuit for
2 controlling power switching devices in a DC to DC converter
3 having first and second converter circuits operating into a
4 common load comprising:

5 a first pulse width modulator controlling the power
6 switching devices of the first converter circuit;

7 a second pulse width modulator controlling the power
8 switching devices of the second converter circuit;

9 a feedback circuit responsive to the voltage across the
10 common load;

11 control circuits for controlling the first and second pulse
12 width modulators responsive to the feedback circuit, the
13 operation of the first and second pulse width modulators being
14 interleaved;

15 the control circuits also being responsive to the difference
16 in currents [current] through the first converter and the second
17 converter to adjust the relative duty cycle of the first and
18 second converters to tend to minimize the difference in the
19 voltage across a sense resistor;

20 the first pulse width modulator, the second pulse width
21 modulator, the feedback circuit and the control circuits being in
22 a single integrated circuit.

1 22. (Three Times Amended) A DC to DC converter having a
2 plurality of converter circuits for operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common
10 oscillator in an interleaved manner, each pulse width modulator
11 controlling one of the plurality of buck converter circuits,
12 whereby the operation of the buck converter circuits is
13 interleaved;

14 a feedback circuit responsive to a voltage across the common
15 load [output];

16 a voltage control circuit controlling the plurality of pulse
17 width modulators responsive to the feedback circuit and a
18 commanded output voltage; and

19 a current balance control circuit responsive to the
20 difference in currents [current] in the plurality of interleaved
21 buck converter circuits and controlling the pulse width

22 modulators to balance the currents [current] in the plurality of
23 interleaved buck converter circuits;

24 the plurality of pulse width modulators and the control
25 circuits being in a single integrated circuit.

1 32. (Three Times Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one
10 of the plurality of buck converter circuits, the operation of the
11 pulse width modulators and the buck converter circuits being
12 interleaved;

13 a feedback circuit responsive to a voltage across the common
14 load;

15 control circuits responsive to the feedback circuit and a
16 commanded output voltage to control a nominal duty cycle of the
17 plurality of buck converter circuits, the control circuits also
18 being responsive to the difference in currents [current] in the
19 plurality of interleaved buck converter circuits to adjust [a]
20 relative duty cycles [cycle] of the plurality of buck converter

21 circuits to balance the currents [current] in the buck converter
22 circuits;
23 the plurality of pulse width modulators and the control
24 circuits being in a single integrated circuit.

1 45. (Three Times Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one
10 of the plurality of buck converter circuits, the operation of the
11 pulse width modulators being interleaved;

12 control circuits for adjusting a nominal duty cycle of the
13 plurality of interleaved buck converter circuits, the control
14 circuits also being responsive to the difference in currents
15 [current] in the plurality of interleaved buck converter circuits
16 to adjust the relative duty cycles [cycle] of the plurality of
17 buck converter circuits to balance the currents [current]
18 therein;

19 the plurality of pulse width modulators and the control
20 circuits being in a single integrated circuit.

1 46. (Twice Amended) A DC to DC converter having first and
2 second converter circuits operating into a common load,
3 comprising:

4 first and second buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck
10 converter circuit;

11 a second pulse width modulator controlling the second buck
12 converter circuit;

13 a feedback circuit responsive to the voltage across the
14 common load;

15 control circuits for controlling the first and second pulse
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current
18 measurements in the first buck converter circuit and the second
19 buck converter circuit for adjusting the relative duty cycle of
20 the first and second pulse width modulators to balance the
21 currents in the buck converter circuits;

22 the first pulse width modulator, the second pulse width
23 modulator, the feedback circuit and the control circuits being in
24 a single integrated circuit.

1 47. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common
10 oscillator in an interleaved manner, each pulse width modulator
11 controlling one of the plurality of buck converter circuits,
12 whereby the operation of the buck converter circuits is
13 interleaved;

14 a feedback circuit responsive to a voltage across the common
15 load;

16 a voltage control circuit for controlling the plurality of
17 pulse width modulators responsive to the feedback circuit and a
18 commanded output voltage; and

19 a current balance control circuit responsive to the
20 difference in currents [current] in the plurality of interleaved
21 buck converter circuits for controlling the pulse width
22 modulators to balance the currents [current] in the plurality of
23 interleaved buck converter circuits;

24 the plurality of pulse width modulators, the feedback
25 circuit, the voltage control circuit and the current balance
26 control circuit being in a single integrated circuit.

1 48. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power
10 switching devices of one of the plurality of interleaved buck
11 converter circuits, the operation of the pulse width modulators
12 and the buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common
14 load;

15 control circuits responsive to the feedback circuit and a
16 commanded output voltage to control a nominal duty cycle of the
17 plurality of buck converter circuits, the control circuits also
18 being responsive to the difference in currents [current] in the
19 plurality of interleaved buck converter circuits to adjust the
20 relative duty cycles [cycle] of the plurality of buck converter

21 circuits to balance the currents [current] in the buck converter
22 circuits;

23 the plurality of pulse width modulators, the feedback
24 circuit and the control circuits being in a single integrated
25 circuit.

1 49. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one
10 of the plurality of buck converter circuits, the pulse width
11 modulators being driven by a common oscillator signal so that the
12 operation of the pulse width modulators is interleaved;

13 control circuits for adjusting a nominal duty cycle of the
14 plurality of interleaved buck converter circuits to control a
15 voltage on the common load, and for responding to the difference
16 in currents [current] in the plurality of interleaved buck
17 converter circuits to adjust the relative duty cycles [cycle] of
18 the plurality of buck converter circuits to balance the currents
19 [current] in the buck converter circuits;

20 the plurality of pulse width modulators and the control
21 circuits being in a single integrated circuit.

1 50. (Twice Amended) A DC to DC converter having first and
2 second converter circuits operating into a common load,
3 comprising:

4 first and second buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck
10 converter circuit;

11 a second pulse width modulator controlling the second buck
12 converter circuit;

13 a feedback circuit responsive to the voltage across the
14 common load;

15 control circuits for controlling the first and second pulse
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current
18 measurements through the first buck converter circuit and the
19 second buck converter circuit to adjust the relative duty cycle
20 of the first and second buck converter circuits;

21 the first pulse width modulator, the second pulse width
22 modulator and the control circuits being in a single integrated
23 circuit.

1 51. (Twice Amended) A DC to DC converter comprising:
2 a plurality of buck converter circuits operating into the
3 common load, each buck converter circuit having an inductor for
4 alternately conducting between the first [and second] power
5 supply terminal and the common load, [terminals,] and the second
6 power supply terminal and the common load;

7 a plurality of pulse width modulators driven by a common
8 oscillator in an interleaved manner, each pulse width modulator
9 controlling one of the plurality of buck converter circuits,
10 whereby the operation of the buck converter circuits is
11 interleaved;

12 a feedback circuit responsive to a voltage on the common
13 output;

14 a voltage control circuit for controlling the plurality of
15 pulse width modulators responsive to the feedback circuit and a
16 commanded output voltage; and

17 a current balance control circuit for controlling the pulse
18 width modulators responsive to a difference in currents [current]
19 in the inductors of the plurality of interleaved buck converter
20 circuits to balance the currents [current] in the plurality of
21 interleaved buck converter circuits;

22 the plurality of pulse width modulators and the control
23 circuits being in a single integrated circuit.

1 52. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power
10 switching devices of one of the plurality of buck converter
11 circuits, the operation of the pulse width modulators and the
12 buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common
14 load;

15 control circuits being responsive to the feedback circuit
16 and a commanded output voltage to control a nominal duty cycle of
17 the plurality of buck converter circuits, the control circuits
18 also being responsive to the difference in currents in the
19 plurality of interleaved buck converter circuits to adjust the
20 relative duty cycles [cycle] of the plurality of buck converter
21 circuits to balance the currents [current] in the buck converter
22 circuits;

23 the plurality of pulse width modulators and the control
24 circuits being in a single integrated circuit.

1 53. (Twice Amended) A DC to DC converter having first and
2 second converter circuits operating into a common load,
3 comprising:

4 first and second buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck
10 converter circuit;

11 a second pulse width modulator controlling the second buck
12 converter circuit;

13 a feedback circuit responsive to the voltage across the
14 common load;

15 control circuits for controlling the first and second pulse
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current
18 measurements in the first buck converter circuit and the second
19 buck converter circuit to adjust the relative duty cycle of the
20 first and second buck converter circuits;

21 the first pulse width modulator, the second pulse width
22 modulator, the feedback circuit and the control circuits being in
23 a single integrated circuit.

1 54. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common
10 oscillator in an interleaved manner, each pulse width modulator
11 controlling one of the plurality of buck converter circuits,
12 whereby the operation of the buck converter circuits is
13 interleaved;

14 a feedback circuit responsive to a voltage across the common
15 load;

16 a voltage control circuit for controlling the plurality of
17 pulse width modulators responsive to the feedback circuit and a
18 commanded output voltage; and

19 a current balance control circuit for controlling the pulse
20 width modulators to balance the currents [current] in the
21 plurality of interleaved buck converter circuits responsive to

22 the difference in currents [current] in the plurality of
23 interleaved buck converter circuits;
24 the plurality of pulse width modulators, the voltage control
25 circuit and the current balance control circuit being in a single
26 integrated circuit.

1 55. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power
10 switching devices of one of the plurality of interleaved buck
11 converter circuits, the operation of the pulse width modulators
12 and the buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common
14 load;

15 control circuits responsive to the feedback circuit and a
16 commanded output voltage to control a nominal duty cycle of the
17 plurality of buck converter circuits, the control circuits also
18 adjusting [a] relative duty cycles [cycle] of the plurality of
19 buck converter circuits to balance the currents [current] in the

20 buck converter circuits responsive to the difference in currents
21 [current] in the plurality of interleaved buck converter
22 circuits;
23 the plurality of pulse width modulators and the control
24 circuits being in a single integrated circuit.

1 56. (Twice Amended) A DC to DC converter having a
2 plurality of converter circuits operating into a common load,
3 comprising:
4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;
9 a plurality of pulse width modulators each controlling one
10 of the plurality of buck converter circuits, the pulse width
11 modulators being driven by a common oscillator signal so that the
12 operation of the pulse width modulators is interleaved;
13 control circuits for adjusting a nominal duty cycle of the
14 plurality of interleaved buck converter circuits to control a
15 voltage on the common load, and for adjusting [a] relative duty
16 cycles [cycle] of the plurality of buck converter circuits to
17 balance the currents [current] in the buck converter circuits;
18 the plurality of pulse width modulators and the control
19 circuits being in a single integrated circuit.

1 57. (Twice Amended) A DC to DC converter having first and
2 second buck converter circuits operating into a common load,
3 comprising:

4 first and second buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for
6 alternately conducting between the first [and second] power
7 supply terminal and the common load, [terminals,] and the second
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck
10 converter circuit;

11 a second pulse width modulator controlling the second buck
12 converter circuit;

13 a feedback circuit responsive to the voltage across the
14 common load;

15 control circuits for controlling the first and second pulse
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current
18 measurements in the first buck converter circuit and the second
19 buck converter circuit to adjust the relative duty cycle of the
20 first and second pulse width modulators to balance the currents
21 in the buck converter circuits;

22 the first pulse width modulator, the second pulse width
23 modulator and the control circuits being in a single integrated
24 circuit.

1 58. (Amended) A DC to DC converter having a plurality of
2 converter circuits for operating into a common load, comprising:

3 a plurality of buck converter circuits operating into the
4 common load, each buck converter circuit having an inductor for
5 alternately conducting between the first [and second] power
6 supply terminal and the common load, [terminals,] and the second
7 power supply terminal and the common load;

8 a plurality of pulse width modulators driven by a common
9 oscillator in an interleaved manner, each pulse width modulator
10 controlling one of the plurality of buck converter circuits,
11 whereby the operation of the buck converter circuits is
12 interleaved;

13 a feedback circuit responsive to a voltage across the common
14 output;

15 a voltage control circuit controlling the plurality of pulse
16 width modulators responsive to the feedback circuit and a
17 commanded output voltage;

18 the plurality of pulse width modulators and the control
19 circuits being in a single integrated circuit.

2 60. (Amended) A DC to DC converter having a plurality of
3 converter circuits operating into a common load, comprising:

4 a plurality of buck converter circuits operating into the
5 common load, each buck converter circuit having an inductor for

5 alternately conducting between the first [and second] power
6 supply terminal and the common load, [terminals,] and the second
7 power supply terminal and the common load;
8 a plurality of pulse width modulators each controlling one
9 of the plurality of buck converter circuits, the operation of the
10 pulse width modulators and the buck converter circuits being
11 interleaved;
12 a feedback circuit responsive to a voltage across the common
13 load;
14 control circuits responsive to the feedback circuit and a
15 commanded output voltage to control a nominal duty cycle of the
16 plurality of buck converter circuits;
17 the plurality of pulse width modulators and the control
18 circuits being in a single integrated circuit.

1 62. (Amended) A DC to DC converter comprising:

2 first and second buck converter circuits operating into a
3 common load, each buck converter circuit having an inductor for
4 alternately conducting between the first [and second] power
5 supply terminal and the common load, [terminals,] and the second
6 power supply terminal and the common load;

7 first and second pulse width modulators driven by a common
8 oscillator in an interleaved manner, each pulse width modulator
9 controlling a respective one of the first and second buck

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10 converter circuits, whereby the operation of the buck converter
11 circuits is interleaved;
12 a feedback circuit responsive to a voltage across the common
13 output;
14 a voltage control circuit controlling the first and second
15 pulse width modulators responsive to the feedback circuit and a
16 commanded output voltage;
17 the plurality of pulse width modulators and the control
18 circuits being in a single integrated circuit.

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64. (Amended) A DC to DC converter comprising:

1 first and second buck converter circuits operating into a
2 common load, each buck converter circuit having an inductor for
3 alternately conducting between the first [and second] power
4 supply terminal and the common load, [terminals,] and the second
5 power supply terminal and the common load;
6

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7 first and second pulse width modulators each controlling a
8 respective one of the buck converter circuits, the operation of
9 the pulse width modulators and the buck converter circuits being
10 interleaved;

11 a feedback circuit responsive to a voltage across the common
12 load;

13 control circuits responsive to the feedback circuit and a
14 commanded output voltage to control a nominal duty cycle of the
15 plurality of buck converter circuits;

16 the plurality of pulse width modulators and the control
17 circuits being in a single integrated circuit.
